THE PROBLEM OF AUTOMATING THERMOPHYSICAL RESEARCH*

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The present stage of the development of scientific research and design-construction work is characterized by the intense introduction of means of automation for controlling different processes and for the more efficient acquisition, processing, and storage of data. This tendency, which is common to different areas of science and technology, is also beginning to manifest itself in research on heat and mass transfer processes, and the design of thermally loaded machines and apparatus. The design of problem-oriented systems for the automatic processing of data enables the operating capability and reliability of the data processing to be increased considerably, eliminates subjective factors, and also enables new, more complex thermal problems to be solved.

The automation and thermal design and experimental development of thermal modes of modern aircraft is of considerable value. Thus, in the case of space and launching apparatus, and multistage space transport systems, the thermal loads are determined not only by the design parameters, but sometimes by the appearance of the apparatus itself, and ensuring the required temperature conditions of operation of the instruments, equipment, construction, and crew cabin, affect the successful carrying out of the flight program.

The practical and technical requirements imposed on aircraft necessitate more rigid tolerances on the temperature conditions on the different systems and equipment with a simultaneous reduction in the relative mass of the construction and a complication in the flight program. This leads to the need for further improved systems to ensure that the aircraft operates under the correct thermal conditions, and that the efficiency and reliability of operation is increased.

The rational solution of this problem requires a detailed design study, an analysis of a large number of alternative versions of the construction and principles of operation of the projected systems, and requires consideration of a variety of often contradictory requirements involving accurate prediction of the main characteristics of the system, and experimental processing of the thermal modes of operation both in the laboratory and under natural conditions. The thermal design of aircraft, and the construction of new types of thermal-protection and temperature-control systems have to be carried out in a fixed, usually very short, time. One of the important conditions for the successful solution of this problem is the necessary level of automation of all these operations, the construction of automated design systems, systems for the automatic control of thermal testing, and systems for processing the experimental data.

Hence, to increase the quality and efficiency of the thermal design it is necessary to develop and introduce modern means of automating thermophysical research. A similar situation also exists in many other areas of science and technology.

A considerable amount has, of course, been achieved in the automation of thermophysical research, but it is still in its initial development stages. However, the papers presented at this seminar indicate some of the successes that have been achieved.† Automated equipment for processing the data from thermal experiments has been designed, and special computer software has been developed.

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